Transient clamp-induced mechanical block of pulmonary vein potentials

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A hybrid atrial fibrillation (AF) ablation procedure (combining an endocardial and epicardial approach under general anesthesia) was performed in a 68-year-old man with symptomatic paroxysmal AF of 4 years duration. The patient also had hypertension and prolapse of the mitral valve. His medication consisted of flecainide, perindopril, and warfarin. Flecainide was stopped 5 days before the procedure. Normal left ventricular (LV) systolic function, an enlarged left atrium (LA) with a volume of 99 mL (normal < 61 mL), minimal LV hypertrophy, and a mild degree of mitral regurgitation were observed on transthoracic echocardiography.

CLINICAL SUMMARY

A His and coronary sinus (CS) catheter were inserted via the left groin. After transseptal puncture guided by transesophageal echocardiography, a long sheath was advanced from the right groin into the LA, and the patient was fully heparinized. After placing a circular mapping catheter (Lasso; Biosense Webster Inc, Diamond Bar, Calif) at the ostium of the pulmonary veins (PVs) one by one, we observed the presence of pulmonary vein potentials (PVP) in sinus rhythm in the right PVs and during pacing from the distal CS catheter in the left PVs. Pacing from the Lasso catheter revealed locale capture in each PV with conduction to the LA. Via a bilateral thoracoscopic approach, we paced from the epicardial side of each PV with a 4-mm tip quadripolar catheter (Biosense Webster Inc) at the level of the Lasso catheter and were able to demonstrate locale capture with conduction to the LA.

After placing the Lasso catheter out of the left superior PV (LSPV), we placed a bipolar radiofrequency (RF) clamp (Atricure Inc, West Chester, Ohio) around the 2 left PVs. We closed the clamp for 1 minute without application of RF to evaluate whether this maneuver would result in conduction block. After the clamp was opened, the Lasso catheter was replaced at the ostium of the LSPV (Figure 1). We noticed dissociated PVPs, which prove exit and entrance block. Pacing sequentially from the epicardial and endocardial side of the LSPV resulted in local capture (PVPs on the Lasso catheter) with no conduction to the LA. We did not use adenosine to demonstrate dormant PV conduction. Twenty-one minutes after having removed the clamp, electrical conduction from the LA to LSPV reappeared on the Lasso catheter with a long interval between the far-field LA potential and the PVP (Figure 2), indicating slow conduction from LA to LSPV. To isolate the PVs, we repositioned and closed the clamp around the left PVs and applied bipolar RF. The right PVs were isolated in the same way using this device. After the last application of bipolar RF, we waited more than 30 minutes. During this waiting period, the cavo-tricuspid isthmus was ablated endocardially using a 3.5-mm tip catheter (ThermoCool; Biosense Webster Inc). We were then able to demonstrate bidirectional block at the level of the PVs from the endocardial and epicardial sides. This finding was also confirmed during infusion of isoproterenol.

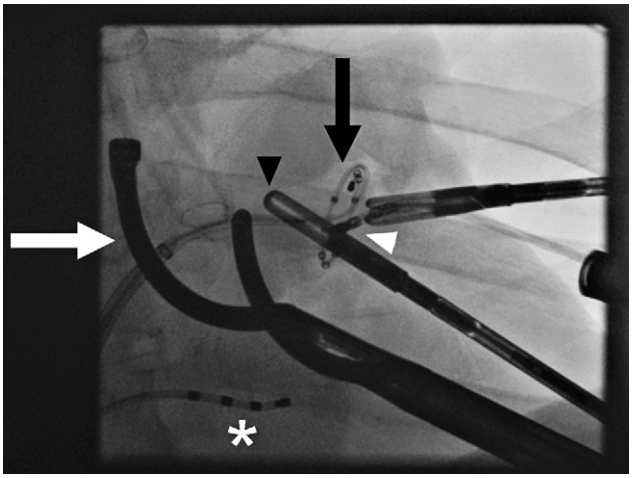

FIGURE 1. Fluoroscopic image shows the opened bipolar RF clamp (*white arrow*) placed epicardially at the antrum of the left PVs, the endocardial circular mapping catheter (*black arrow*) at the ostium of the LSPV, the quadripolar catheter on the epicardial surface of the LSPV (*white arrowhead*), a His catheter (*), and a surgical forceps (*black arrowhead*).

Conduction block over anatomic structures sometimes occurs during manipulation of catheters in the cardiac chambers. This conduction block is ascribed to mechanical trauma and is referred to as ‘‘catheter-induced trauma.’’ Catheter-induced trauma has been reported in the atrioventricular node, His bundle, accessory pathways, and others.[1,2] This case report demonstrates for the first time

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FIGURE 2. Circular mapping catheter at the ostium of the LSPV registers a local left PVP that is dissociated from the LA during sinus rhythm (*). A few seconds later, conduction from the LA to the LSPV reappears: PVPs (*arrowhead*) are inscribed late after far-field left atrial activity (*arrow*).

how clamp-induced pressure or trauma from the epicardium leads to transient block of PVPs. This finding is of paramount importance for cardiac surgeons and electrophysiologists involved in the field of surgical or hybrid AF ablation. As stated in the Heart Rhythm Society/European Heart Rhythm Association/European Cardiac Arrhythmia Society Expert Consensus Statement, ablation strategies that target the PVs or PV antrum are the cornerstone for most AF ablation procedures, but if the PVs are targeted, complete electrical isolation should be the goal.[3] Benussi and colleagues[4] described recovery of PV conduction in 15% of patients 3 weeks after epicardial ablation with a bipolar RF clamp. They suggest that small gaps around the PV antrum can be masked by edema owing to heart trauma and that resolution of swelling during recovery of ablation may allow for PV reconnection. Our case clearly illustrates this finding because trauma (closing of the clamp) leads to transient isolation of the PV.

CONCLUSIONS

A clinical implication of this case report is that, because of unnoticed mechanical block, epicardial ablation should be performed on all PVs even if no PVPs are seen.

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